REMARKS/ARGUMENTS

In the specification, the paragraph beginning at page 11, line 15 has been amended to remedy typographical errors. Also, in the claims, claims 1, 12, 20 and 23 have been amended to remedy typographical errors.

Applicants have carefully reviewed the Examiner's Office Action dated November 6, 2003 and reconsideration of the application is respectfully requested for the following reasons:

In Nealey et al. and Kim et al., i.e., a patterning method called micromolding in capillaries (MIMIC) or capillary micromolding (See Fig. 11.13 of Nealey et al. and Figs. 1 and 10a of Kim et al.), the ends of a PDMS mold are cut off so as to make both ends of the void space in the mold or recessed channels open to air and the channels are all interconnected. The mold thus prepared is placed on a support and then a liquid drop of prepolymer is placed at one open end. The liquid prepolymer is sucked into the interconnected channels by capillarity, filling the channels. The filled liquid prepolymer is polymerized either thermally or by exposure to ultra-violet light, which transforms the liquid to a solid. The mold (stamp) is then removed and the patterned, solid polymeric layer remains on the support, completing the patterning.

In the present invention as described in the claims, a PDMS mold is also used. However, both ends of the mold may not be cut off and therefore, the void space in the mold or recessed channels are closed and not open to air. Furthermore,

the void spaces on the channels are not necessarily interconnected. In fact, the mold can have any type of channels or void space, including those that are isolated and not interconnected. A polymer film is coated onto a support (substrate), for example by spin-coating, and dried. Onto this solid film, the mold is placed. To make the polymer mobile, it is heated above the glass transition temperature (Tg). By capillarity, the mobile polymer rises into the void space and fills the space. After the void space is filled, the temperature is lowered to room temperature and the mold is removed, completing the patterning. When Tg is lower than room temperature, no heating is needed but cooling would be needed (See lines 19-23 of page 9 of the specification).

The consequences of these differences are far reaching in terms of patterning capability. MIMIC of Nealey et al. and Kim et al. is a limited patterning method that is applicable only to those patterns in which all the void space has to be open-ended and more importantly all interconnected and thus the frequent use of the term, grid-like pattern, in the patent. Otherwise, the fluid cannot fill all the void space. On the other hand, the present invention is a general patterning method that is applicable to any pattern, including closed or open pattern. In general, the pattern needed for any device fabrication as in integrated circuits includes isolated elements that are not interconnected. Therefore, the present invention is general whereas MIMIC of Nealey et al. and Kim et al. is specific only to a limited class of patterns. Another consequence is that MIMIC of Nealey et al. and Kim et al. is not applicable to a large area since a fluid can travel only a limited distance by the capillary force.

In contrast, the present invention is applicable, in principle, to any area since the vertical capillary rise into the voids is at most less than 10 μm and the mold can be as large as any desired substrate area, which is simply placed over the whole substrate area.

Another basic difference between the present invention and MIMIC of Nealey et al. and Kim et al. lies in the transformation needed for the patterning. In MIMIC, a chemical transformation (reactions) is needed for the fluid to transform itself into a solid form for the patterning, which results in a high molecular weight material. For example, when a prepolymer fluid is hardened by ultra-violet light or thermal energy, a crosslinking reaction (polymerization) leads to a molecular weight higher than that of the prepolymer. In contrast, in the present invention, no chemical change but only a physical change is involved when heated to the glass transition temperature and the molecular weight of the material remains the same. Therefore, the fidelity of the pattern formed by MIMIC is poor since the chemical transformation needed for the patterning and subsequent change in the molecular weight causes either shrinkage or swelling of the material. Adding to this fidelity problem is the distance a fluid has to travel in MIMIC, which causes slightly unfilled voids and tapered structure at the ends of channels where the capillary force approaches zero.

Therefore, the basic concept of the present invention is totally different and not taught or suggested from the disclosures of Nealey et al. and Kim et al.

1. Rejection of Claims 1 and 4 Under 35 USC §102(b) as being anticipated by the Publication of Nealey et al.

In Nealey et al., the material to be patterned (or molded) has to be a fluid for MIMIC to work, which is sucked into the void (channels) when drops of the fluid is placed at one ends of the open channels, the other ends being open for the capillarity to work. In contrast, in the present invention, the material can be a solid or fluid to work since (the protruded portion of) the mold is rendered to be in contact with the polymer material (See the step (c) of claim 1). Then, the polymer material in contact with the protruded portion of the mold into an empty space of the recessed portion thereof by using capillary force (see the step (d) of claim 1). That is, in Nealey et al., capillarity is utilized to make a fluid locally placed outside of a mold to be sucked (horizontally) into the inside of the mold. However, in the present invention, capillarity is utilized to cause capillary rise (vertical) within and inside the mold over the whole area.

Accordingly, the present invention of claim 1 is not disclosed or suggested in Nealey et al. and, therefore, it is respectfully submitted that claim 1 defines a patentable invention over the prior art, including Nealey et al., and is, therefore, allowable.

Therefore, it is also believed that claims 4 directly depending on claim 1 are allowable for the same reasons indicated with respect to the claim 1 and further because of the additional features recited therein which, when taken alone

and/or in combination with the features recited in the claim 1 remove the invention defined therein further from the disclosures made in the cited references including Nealey et al.

2. Rejection of Claims 1, 3, 4, 6, 12, 14, 15, 17 and 10 Under 35 USC §102(e) as being anticipated by Kim et al.

In Kim et al., the material to be patterned (or a precursor of a patterned polymeric structure) has to be a fluid 36, which is sucked into the void (or channels 32) when drops of the fluid 36 is placed at one ends of the open channels 32, the other ends being open for the capillarity to work. In contrast, in the present inventions as described in claims 1 and 12, the material can be a solid or fluid to work since (the protruded portion of) the mold is rendered to be in contact with the polymer material (see the step (c) of claim 1 and the step (d) of claim 12). Then, the polymer material in contact with the protruded portion of the mold into an empty space of the recessed portion thereof by using capillary force (see the step (d) of claim 1 and the step (e) of claim 12). That is, in Kim et al., capillarity is utilized to make a fluid locally placed outside of a mold to be sucked (horizontally) into the inside of the mold (See Fig. 1 and col. 10, line 62 to col.11, line 15 of Kim et al.). However, in the present inventions, capillarity is utilized to cause capillary rise (vertical) within and inside the mold over the whole area.

Accordingly, the present inventions of claims 1 and 12 are not disclosed in Kim et al. and, therefore, it is respectfully submitted that claims 1 and 12

define a patentable invention over the prior art, including Kim et al., and is, therefore, allowable.

Therefore, it is also believed that claims 4, 6, 15, 17 and 19 directly depending on claim 1 or 12 are allowable for the same reasons indicated with respect to the claim 1 or 12 and further because of the additional features recited therein which, when taken alone and/or in combination with the features recited in the claim 1 or 12 remove the invention defined therein further from the disclosures made in the cited references including Kim et al.

Further, in Kim. et al., a solvent that dissolves the photoresist, instead of a prepolymer fluid, is placed at one ends of open channels made by contacting the mold 20 with the thin layer 124 of chromium (See col.26, lines 23-31 of Kim et al.). That is, when the solvent is sucked into the channels it dissolves the photoresist present at the bottom of the channels and the dissolved photoresist in fluid form is removed through the other ends of the channels, which is clearly different from the present invention of claims 3 and 14, wherein a fluidizing material is permeated into the polymer material deposited on the substrate or the thin film layer before the mold is rendered to be in contact with the polymer material, the purpose of which is to make the polymer material mobile to be collected into the recessed portion of the mold.

Accordingly, the present inventions of claims 3 and 14 are not disclosed in Kim et al. and, therefore, it is respectfully submitted that claims 3 and 14

define a patentable invention over the prior art, including Kim et al., and is, therefore, allowable.

3. Rejection of Claims 2, 7-11, 13, 18 and 20-23 Under 35 USC §103(a) as Being Unpatentable Over Kim et al.

It has been discussed fully above that there are the differences between Kim et al. and the present inventions of claims 1, 3, 12 and 14. Therefore it is also believed that claims 2, 7-11, 13, 18 and 20-23 directly or indirectly depending on claim 1, 3, 12 or 14 are allowable for the same reasons indicated with respect to the claims 1, 3, 12 and 14 and further because of the additional features recited therein which, when taken alone and/or in combination with the features recited in the claims 1, 3, 12 and 14 remove the invention defined therein further from the disclosures made in the cited references including Kim et al.

Additionally, one of the basic differences between Kim et al. and the present inventions of claims 2 and 13 has to be noted here. In Kim et al., the material to be patterned has to be a fluid, a free-flowing liquid. However, in the present inventions, the material can be a solid, a non-fluid material. To pattern this solid (non-fluid) material, heating is added to make the solid mobile enough for the capillary rise. It is noted in this regard that no mention of using a solid as a starting material and no mention of heating are made in Kim et al., simply because the material there is a free-flowing liquid. Heating is an integral part of the present

inventions in that by doing so, a solid material can be molded or patterned. Accordingly, claims 2 and 13 should stand as claimed.

4. Rejection of Claims 5 and 16 Under 35 USC §103(a) as being Unpatentable over Kim et al., and further in view of Chou

Likewise, it has been discussed fully above that there are the differences between Kim et al. and the present inventions of claims 1 and 12 and, therefore, claims 1 and 12 define patentable inventions over Kim et al. Further, Chou does not disclose nor suggest the present inventions as described in claims 1 and 12.

Therefore, it is also believed that claims 5 and 16 directly depending on claim 1 or 12 are allowable for the same reasons indicated with respect to the claims 1 and 12 and further because of the additional features recited therein which, when taken alone and/or in combination with the features recited in the claims 1 and 12 remove the invention defined therein further from the disclosures made in the cited references including Kim et al.

5. Rejection of Claim 22 Under 35 USC §112 as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention

Claim 22 has been amended to depend on claim 21 to particularly point out and distinctly claim the subject matter which applicant regards as the invention, without adding any new matter and in full compliance with the statutory requirements. The amended claim 22 is fully supported by the original

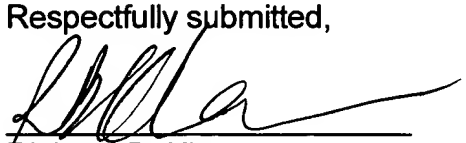
disclosure. In view of the amendments made above and for the reasons states above, it is respectfully submitted that claim 22 is now in condition for allowance; and, therefore, the Examiner's early allowance thereof is respectfully requested.

Applicant believes that this is a full and complete response to the Office Action. For the reasons discussed above, applicant now respectfully submits that all of the pending claims are in complete condition for allowance. Accordingly, it is requested that claims 1 to 23 be allowed in their present form. If the Examiner feels that any issues that remain require discussion, he is kindly invited to contact applicant's undersigned attorney to resolve the issues.

Should the Examiner require or consider it advisable that the specification, claims and/or drawings be further amended or corrected in formal respects, in order to place the case in condition for final allowance, then it is respectfully requested that such amendment or correction be carried out by Examiner's Amendment and the case be passed to issue.

Alternatively, should the Examiner feel that a personal discussion might be helpful in advancing this case to allowance, the Examiner is invited to telephone the undersigned at any time.

Respectfully submitted,



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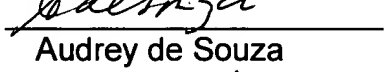

Audrey de Souza

Date: 2/6/04